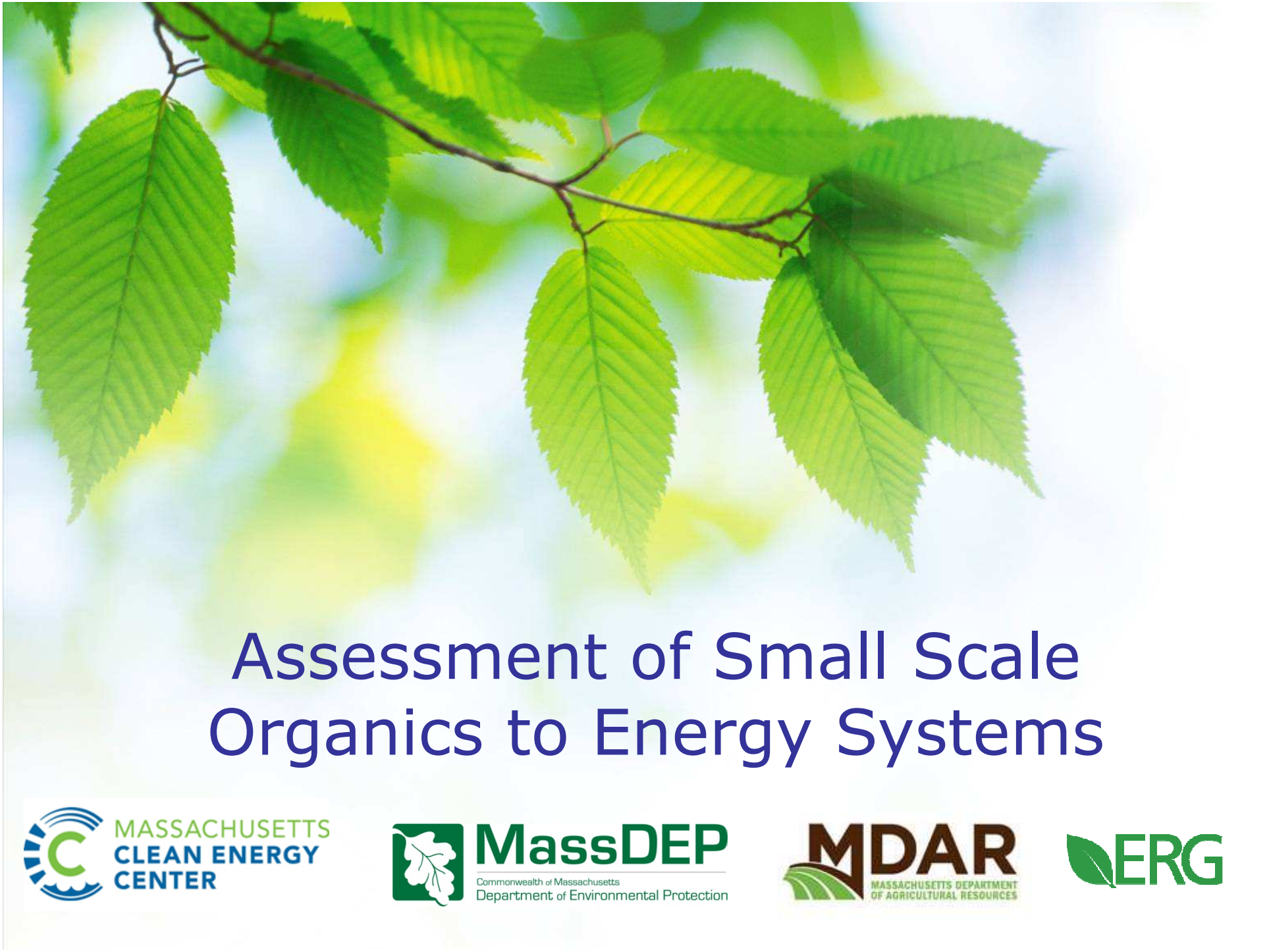


Assessment of Small Scale Organics to Energy Systems

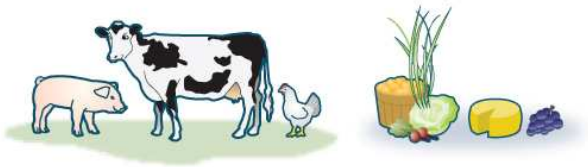
MASSACHUSETTS CLEAN ENERGY CENTER

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

MDAR
MASSACHUSETTS DEPARTMENT OF AGRICULTURAL RESOURCES

ERG

Basic Anaerobic Digester System Flow Diagram



Digester Inputs
(manure, organic substrates)

AgSTAR
www.epa.gov/agstar

All of the opportunities presented will not be appropriate for all digester systems based upon technical and financial constraints.

Anaerobic Digester

Digestate

Biogas

Conditioning to remove H_2O & H_2S

Processing to remove CO_2

Solids Separator

Liquids

Solids

Supplemental Heat for Digester

Medium-BTU Biogas
(600-700 BTUs/scf)
Boiler, heater, chiller, etc.

Electricity
Internal combustion engine (early stage: microturbines, fuel cells)

Biomethane
(900-1000 BTUs/scf)
Natural gas pipeline quality, vehicle fuel (CNG/LNG), feedstock

Lagoon/ Liquid Storage

Advanced Treatment

Fiber-based Products

Fertilizer (NPK)

Recaptured Heat

Compost Soil Amendment

Bedding

Discharge

Reuse

Concentrated Fertilizer

Fertilizer for field or greenhouse crops, flush water

Farm or Neighbor Use
Building heating, greenhouse, food storage, adjacent commercial/ industrial needs, etc.

CNG

Energy Company
Electric utility, natural gas pipeline, vehicle fueling station

Project Purpose

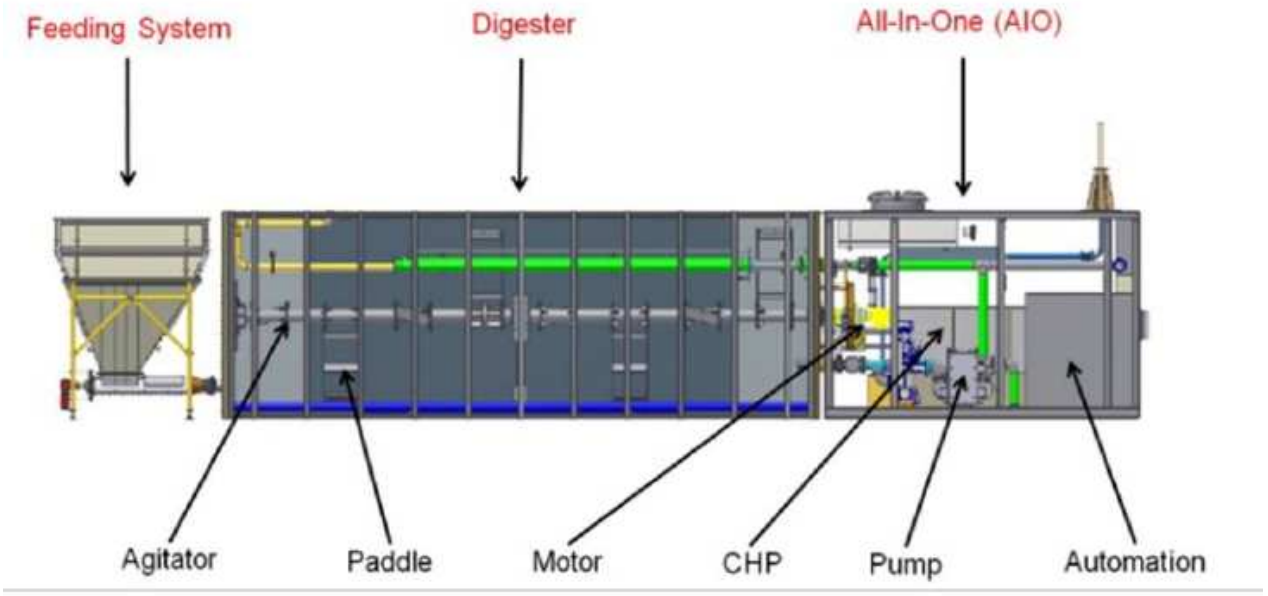
- Support reduction of organics disposal through landfills and incineration
- Promote the generation of energy from organics
- Fill an information gap on smaller systems
  - ½ ton to 30 tons per day
  - Exclude systems designed for woody biomass
  - Systems suitable for food waste

Identify Small Technologies

- Wet and dry AD
- Composting w/heat recovery
- Commercially available
- Operational outside U.S. okay
- Appropriate for small livestock farms, crop agricultural operations, food waste generators, or local community waste management facilities

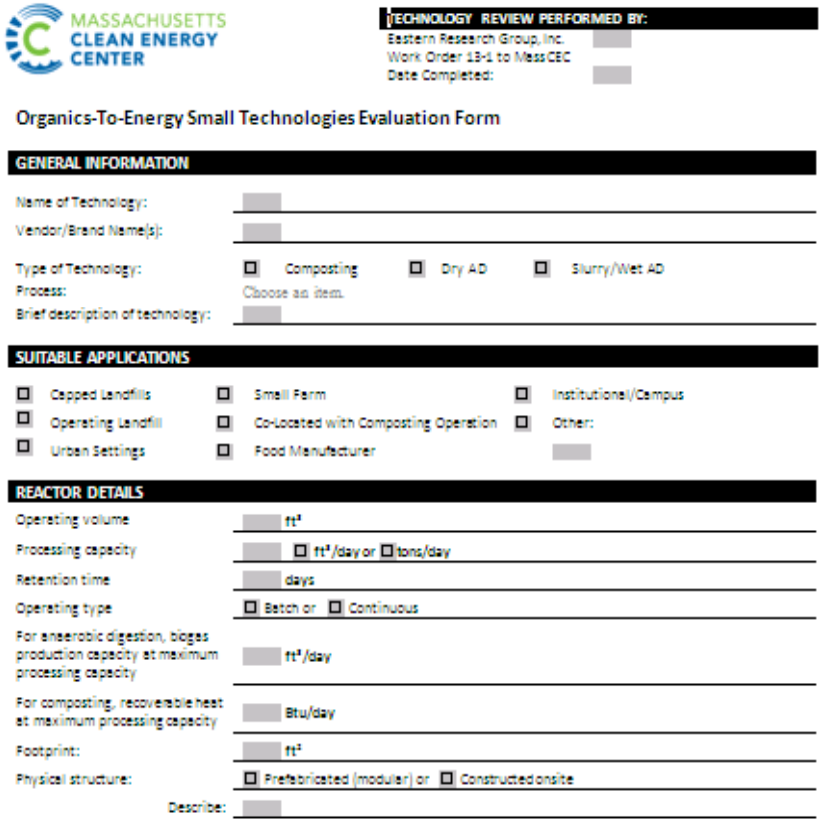
Technologies to be Assessed

- Reviewed with American Biogas Council
- Removed financially unstable companies or pure R&D
- Excluded unresponsive European firms



Evaluation Form

- Collect summary info
  - Suitable uses
  - Operation and maintenance requirements
  - Feedstock options
  - Output/digestate
  - Financial info
  - Vendor info



MASSACHUSETTS CLEAN ENERGY CENTER

TECHNOLOGY REVIEW PERFORMED BY:
Eastern Research Group, Inc.
Work Order 13-1 to MassCEC
Date Completed:

Organics-To-Energy Small Technologies Evaluation Form

GENERAL INFORMATION

Name of Technology:
Vendor/Brand Name(s):
Type of Technology: ☐ Composting ☐ Dry AD ☐ Slurry/Wet AD
Process: Choose an item.
Brief description of technology:

SUITABLE APPLICATIONS

☐ Capped Landfills ☐ Small Farm ☐ Institutional/Campus
☐ Operating Landfill ☐ Co-Located with Composting Operation ☐ Other:
☐ Urban Settings ☐ Food Manufacturer

REACTOR DETAILS

Operating volume ft³
Processing capacity ☐ ft³/day or ☐ tons/day
Retention time days
Operating type ☐ Batch or ☐ Continuous
For anaerobic digestion, biogas production capacity at maximum processing capacity ft³/day
For composting, recoverable heat at maximum processing capacity Btu/day
Footprint: ft²
Physical structure: ☐ Prefabricated (modular) or ☐ Constructed onsite
Describe:

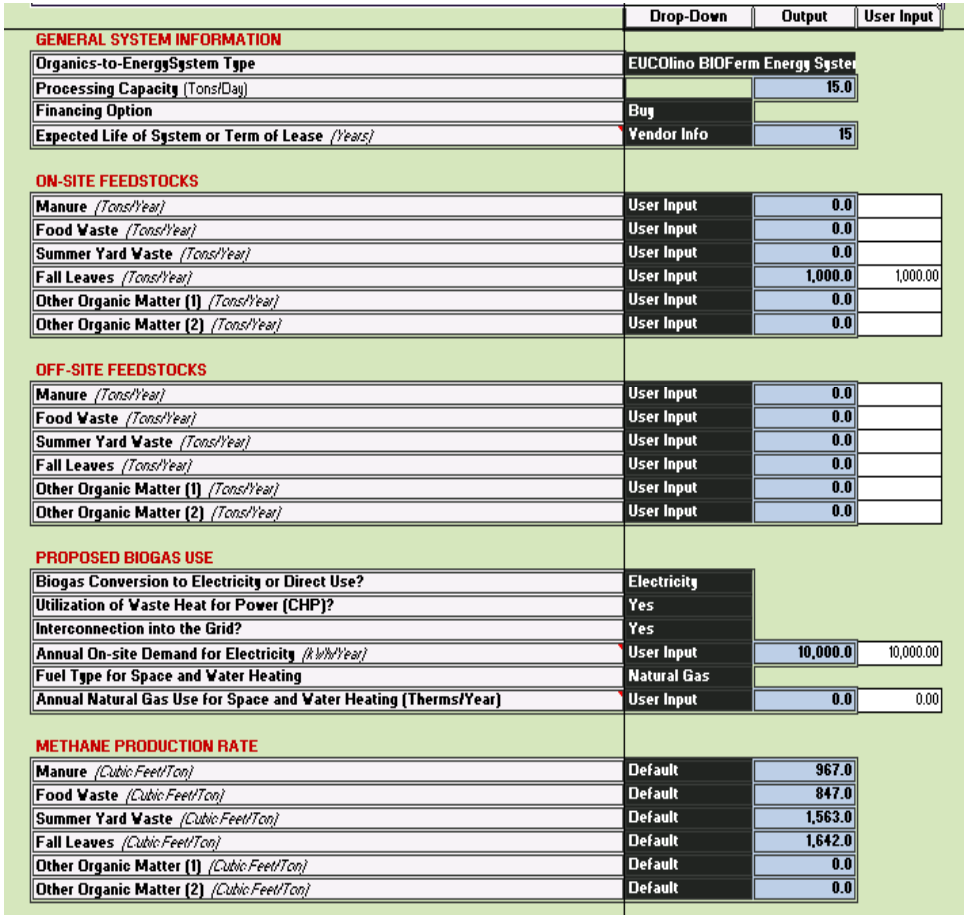
ERG

Lessons Learned

- Vendors wanted more time to fill out information
- Requested data not always available
- Apples to apples comparison may be difficult

Economic Tool

- Creating a pre-screening tool
- Planning to use data from forms
- Providing default values for inputs



	Drop-Down	Output	User Input
GENERAL SYSTEM INFORMATION			
Organics-to-EnergySystem Type	EUCOlino BIOFerm Energy Syster		
Processing Capacity (Tons/Day)		15.0	
Financing Option	Buy		
Expected Life of System or Term of Lease (Years)	Vendor Info	15	
ON-SITE FEEDSTOCKS			
Manure (Tons/Year)	User Input	0.0	
Food Waste (Tons/Year)	User Input	0.0	
Summer Yard Waste (Tons/Year)	User Input	0.0	
Fall Leaves (Tons/Year)	User Input	1,000.0	1,000.00
Other Organic Matter (1) (Tons/Year)	User Input	0.0	
Other Organic Matter (2) (Tons/Year)	User Input	0.0	
OFF-SITE FEEDSTOCKS			
Manure (Tons/Year)	User Input	0.0	
Food Waste (Tons/Year)	User Input	0.0	
Summer Yard Waste (Tons/Year)	User Input	0.0	
Fall Leaves (Tons/Year)	User Input	0.0	
Other Organic Matter (1) (Tons/Year)	User Input	0.0	
Other Organic Matter (2) (Tons/Year)	User Input	0.0	
PROPOSED BIOGAS USE			
Biogas Conversion to Electricity or Direct Use?	Electricity		
Utilization of Waste Heat for Power (CHP)?	Yes		
Interconnection into the Grid?	Yes		
Annual On-site Demand for Electricity (kWh/Year)	User Input	10,000.0	10,000.00
Fuel Type for Space and Water Heating	Natural Gas		
Annual Natural Gas Use for Space and Water Heating (Therms/Year)	User Input	0.0	0.00
METHANE PRODUCTION RATE			
Manure (Cubic Feet/Ton)	Default	967.0	
Food Waste (Cubic Feet/Ton)	Default	847.0	
Summer Yard Waste (Cubic Feet/Ton)	Default	1,563.0	
Fall Leaves (Cubic Feet/Ton)	Default	1,642.0	
Other Organic Matter (1) (Cubic Feet/Ton)	Default	0.0	
Other Organic Matter (2) (Cubic Feet/Ton)	Default	0.0	

Current Status

- QAing technical information and asking follow-up questions
- Running economic model to get basic financial information
- Final report and economic tool expected to be completed by end of June.

Contact Information

- Amy Barad, Massachusetts Clean Energy Center
  617-315-9310, abarad@MassCEC.com
- Greg Cooper, Department of Environmental Protection
  617-292-5988, greg.cooper@state.ma.us
- Gerald Palano, Department of Agricultural Resources
  617-626-1706, gerald.palano@state.ma.us
- Amy Stillings, Eastern Research Group, Inc.
  781-674-7277, amy.stillings@erg.com
- Cortney Itle, Eastern Research Group, Inc.
  703-424-8360, cortney.itle@erg.com

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